HERCULES
CHEMICAL SPECIALTIES

Hercules Incorporated
P.O. Box 1517
Brunswick, GA 31521-1517
(912) 265-3550

June 25, 1997

Mr. Leo Francendese
United States
Environmental Protection Agency
Region IV WMD/ERRB
Atlanta Federal Center
100 Alabama Street
Atlanta, GA 30303

Dear Leo:

Enclosed are materials relating to the dredging history of Terry Creek. It appears to be fairly conclusive that potentially contaminated spoils were not placed on the trailer park area nor in the Riverside development.

We are still investigating the spoils area west of the Riverside development. As we develop more information on this site, we will send it to you.

I am enclosing a series of memos, reports and photos that illustrate the above. I am trying to obtain aerial photos showing the era from 1969 to 1972. Also, enclosed is an index of the enclosures.

Very truly yours,

Wayne R. Quinn

WRQ:jss

Enclosure

Index of Attachments

No. 1 - Letter to Colonel Strohecker from Governor Carter. (E-2 is the spoils area southwest of Riverside, 3B & 4B is the dredge spoils site across DuPree Creek from the Hercules outfall.)

No. 2 - COE memo to Garrett from Richard Hill discussing the Terry Creek channel maintenance with some references to dredging history and disposal sites.

No. 3 - Terry Creek Disposal site summary by K. Morgan 03/01/94 of the COE.

No. 4 - Series of letters in 1971 & 72 discussing spoils sites.

No. 5 - Dr. Reimold's 1973 report.

No. 6 - Photocopy of 1971 aerial photo showing that trailer park was established before dredging of potentially contaminated spoils.

No. 7 - Photocopy of 1972 aerial showing dredge spoil site being built and trailer park in place before dredging of potentially contaminated spoils.

No. 8 - Photocopy of 1968 aerial showing Riverside residential high ground created before dredging of potentially contaminated spoils. Note that high ground in southern tip of diked area southwest of Riverside has not been created.

No. 9 - 1974 aerial showing that high ground has been created in southern tip of spoils area southwest of Riverside.

No. 10 - Detail cropped from No. 9 (inverted) showing high ground in odd shaped area southwest of developed land in Riverside.

Attachment #1

Executive Department
Atlanta 30334

Jimmy Carter
GOVERNOR

Hamilton Jordan
EXECUTIVE SECRETARY

February 24, 1972

Colonel Howard L. Strohecker
District Engineer
Department of the Army
Corps of Engineers, Savannah District
P. O. Box 889
Savannah, Georgia 31402

Re: Terry Creek Dredging Project

Dear Colonel Strohecker:

Pursuant to the understanding between Governor Carter of the State of Georgia and Colonel Strohecker, District Engineer of the Savannah District Army Corps of Engineers, that they would coordinate their efforts to find suitable spoil areas for the above-referenced project, this advises that Areas E-2, 3B, 4B as shown on the attached plat (U. S. Army Corps of Engineers, Segment "I", Brunswick Harbor, August 22, 1951 as revised November 22, 1971, Project No. C-423), with 150' setbacks for dike construction along Terry and Dupree Creeks are acceptable to the State of Georgia and its various agencies.

Thank you for your cooperation in this matter and you at your discretion may proceed most expeditiously to complete this project.

Sincerely,

Jimmy Carter
Governor

JC/bjh

cc: See attached list.

Reference #2

DISPOSITION FORM
For use of this form, see AR 340-15; the proponent agency is TAGO

REFERENCE OR OFFICE SYMBOL
CESAS-PD-S

SUBJECT Maintenance of Terry Creek, Brunswick Harbor

THRU ~~PD~~ OPL 3/1

FROM PD-S

DATE 29 Feb 88
Niessen/jr/5799

CMT 1

TO OP-PN (Garrett)

1. Reference to your DF dated, 16 Sep 87, subject as above.

2. The attached report presents a description, evaluation, and recommendations concerning continued Federal maintenance of Terry Creek.

RICHARD A. HILL
Chief, Economic & Social Analysis Br.

Atch

Reference #5
Site: Terry Creek Dredge Spoil Areas/ Hercules Outfall
EPA ID# GAD 982 112 658

DA Form 2496-E

ECONOMIC ANALYSIS
TERRY CREEK, BRUNSWICK, GEORGIA
O & M JUSTIFICATION

Project Description

The Terry Creek Project was authorized under the River and Harbor Act of 1938, (House Document 690) for a channel 10 feet deep, 80 feet wide and 1.4 miles long. The project was completed in 1939. Maintenance dredging was performed during 1940, 1941, 1942, 1946, 1972, 1978, 1982, 1986, and 1987. Originally maintenance dredging was to be performed every two years.

Existing Conditions

A survey of the Terry Creek channel during January, 1988, revealed that shoaling had reduced controlling depth to about four feet. Average tidal range is about 7.5 ft., which provides 11.5 ft of water at high tide. Only two commercial users of the channel were identified during a recent field and telephone survey of the area. Recreational use of the channel could not be verified and is considered to consist of small boats using the creek on an infrequent basis.

Hercules Inc., is the primary user of the Terry Creek channel. This firm imports resin laden tree stumps from Bahamas, Mexico, and Belize on a self-propelled vessel 314 feet long, 44 feet wide having a maximum draft of 14 feet. A full load of stumps averages 1900 short tons resulting in a loaded draft of eleven feet. The vessel only navigates the channel at high tide during daylight hours, according to a Brunswick Harbor Pilot. The ship makes an average of eighteen trips per year for an average annual volume of 34,200 short tons of stumps. Once the stumps arrive at dockside they are fumigated for forty-eight hours with methyl bromide and then off-load to rail cars or stored in piles adjacent to the creek. The processing plant is across the street from the rail/storage yard.

Randy Spell Construction Company is the other commercial user of the Terry Creek Channel. This firm leases a small, creek side piece of property several hundred yards upstream of Hercules Inc. This firm uses a barge and the pushboat to haul dock pilings and construction materials for water side development. The barge is a 70'x32'x5' deck barge and pushboat is 37 ft. long with a 5 ft. draft. Prior to the 1987 dredging of Terry Creek, Mr. Spell indicated that his boat runs aground an average of 3 times a year resulting in damages of about $1,000 per grounding. Also, without the authorized channel depth his vessel would have to wait for higher tides and sometimes load materials at alternative sites. The estimated value of the delays and use of alternative

sites is $16,000 annually without channel maintenance. Mr. Spell said he could use a larger barge and push boat since his business is expanding. Also, he would like to start a boat repair business for medium to large private boats. The viability of these ideas depends on regular channel maintenance.

Maintenance Costs

Dredging in Terry Creek has become more regular during the last decade. The creek has been dredged three time since 1978 with an average annual removal rate of 87,621 cubic yards of material. At a cost of $1.16 per cubic yard, average annual dredging costs amount to $101,640. Disposal site preparation costs have been incurred during each of the last three dredging periods. In 1987, $250,000 was spent rebuilding the dikes and shaping the disposal site. No additional site work will be necessary until 1996 assuming two more deposits of material. At this time, the site will have to be reworked similar to the measures taken in 1987 in order to accept a third deposit. By 1998 the site would have to undergo extensive testing and study prior to attempting a fourth deposit. In this analysis, based on existing information, the site is considered to have a useful life of ten years with a $250,000 rehabilitation after eight years. The average annual value of site preparation is $19,770, using a 8 5/8 percent rate and the assumptions as stated earlier. There is another authorized disposal site close to the existing site, however it is currently inhabited by a variety of trailers and other structures. Furthermore, the dredged material from Terry Creek is contaminated with toxaphene and disposal in uncontaminated sites could pose environmental problems. Therefore, the period of analysis is limited to the remaining life of the existing site.

Maintenance Benefits

If maintenance on the Terry Creek Channel were to cease, Hercules would have to find an alternative site to deliver their stumps. There is an alternative site at the Brunswick Port Authority Dock a couple of miles across town. The additional costs associated with using the Port Authority facility include dockage fees (5 days/trip), stevedoring, temporary storage, loading charges and truck hauling to the Hercules plant or storage site. Hercules computed these extra charges at about $20/ton (not including any increased cost associated with use of methyl bromide at a new site). This amounts to an additional cost of $684,000 for stump transportation.

Maintenance benefits for the Randy Spell Construction Company amount to preventing damages and eliminating delays and alternative loading sites. The average annual value of these benefits are $3,000 and $16,000 respectively.

Summary

Average annual benefits and costs for maintaining Terry Creek are summarized as follows:

ITEM	AVERAGE ANNUAL VALUE
BENEFITS	
Extra shipping charges	$604,000
Delay elimination, loading problems	16,000
Damage prevention	3,000
Total	$703,000
COSTS	
Dredging	$101,640
Disposal site preparation	19,770
Total	$121,410

Benefit-to-cost-ratio 5.8 to 1

1987 prices and development, 8 5/8 percent rate, ten year period of analysis based on remaining life of current disposal site.

CONCLUSION

Continued Federal maintenance of Terry Creek should consider more than just the B/C ratio. The additional points to consider, among others, are:

1. Ninety-seven percent of the total benefits accrue to one company, who also happens to be responsible for the toxaphene in Terry Creek.

2. The dredged material is polluted and requires special handling/monitoring. This will result in continued extra charges for dredging the material.

3. The current disposal site is approaching capacity and is increasingly expensive to use. The alternative site has people living in it who will have to be relocated. This can be time consuming and expensive.

4. There will probably be some environmental concerns about contaminating another disposal site with the material from Terry Creek.

5. The channel seems to shoal up quickly after dredging. The channel was dredged to ten feet during the Spring of 1987 and within eight months had a controlling depth of four feet.

Attachment #2

CESAS-OP-R
Prepared by K. Morgan
1 Mar 94

TERRY CREEK DREDGE DISPOSAL SITE SUMMARY

Terry Creek Project, near Brunswick, Georgia, was authorized by the Rivers and Harbors Act of 1938 as a 10 foot deep, 80 foot wide, 1.4 mile long navigation channel. Later legislation lengthened the project to 1.7 miles.

The project was completed in 1939. Early maintenance dredging occurred in 1940, 1941, 1942, and 1946. No dredging occurred again until 1972, followed by dredging in 1978, 1983, 1987, and 1988/89.

Throughout its life, Terry Creek Project's main channel user was and is Hercules, Inc., a chemical manufacturer with a plant near the creek. Hercules imported raw materials (primarily tree stumps) via the creek. The Hercules plant produced toxaphene, a chlorinated camphene insecticide from 1948 until its use was banned 1980. In-house Corps documents report Hercules discharged approximately 250-300 pounds of toxaphene into the creek prior to 1972. Corps documents state that prior to 1972, the creek was virtually sterile. Corps employees report that, in that era, boat operators in the Brunswick area often used the creek to kill barnacles lodged to boat hulls by mooring their vessels in the creek for a day or two.

In 1972, the Clean Water Act required Hercules to build and use a water treatment plant to control and minimize the amount of toxaphene being discharged. Corps documents from the 1980s and 1990s make reference to a 1972 spill of Toxaphene by Hercules into the creek, but no documents from that era discuss it. Corps employees remember something about drums being spilled from a transport barge, but none seem to have any clear and direct information about the spill.

Prior to 1950, the Corps used a disposal area sometimes known as "Tract 2" beside Terry Creek. However, in 1972, Georgian environmentalists protested the dredging of Terry Creek

silts onto the original dredge disposal area adjacent to the Torras Causeway beside Terry Creek. Their letters of concern primarily focused on the protection and preservation of marshland and the aesthetic impacts of dredge material rather than toxaphene contamination. However, Governor Jimmy Carter's new release when he requested that the Corps stop work did express a concern about the toxaphene as well as these other concerns. It is unclear in Corps records how much, if any, of the 1972 dredge disposal material was placed on the old disposal site.

The Corps worked with state and federal officials and with the City of Brunswick and Hercules, Inc. to resolve the problems. They settled on the identification and acquisition of a new dredge disposal area. The City of Brunswick as local assurer and Hercules, Inc. were both active in the acquisition of easements for the disposal site. Hercules is part owner in at least one tract of the disposal area.

Many agencies were involved in the selection of the dredge disposal site on which EPA is focusing. EPA, the U.S. Fish and Wildlife Service and the State of Georgia all participated in the selection of the site and the minimization of impacts. Later in-house Corps documents in the 1980s and 1990s make reference to a formal agreement entered into by the State of Georgia, Hercules and Corps concerning the designation of the Terry Creek Disposal Area as the only acceptable disposal site for Terry Creek dredge material. However, no formal written agreement was located.

The Corps as part of its response to interagency concerns engaged the services of the University of Georgia's Reimold and Durant who had already established themselves as experts in toxaphene impacts on fisheries and wildlife studying the same area. Their study culminated in a report in 1973: *Toxaphene Content of Estuarine Fauna and Flora Before, During and After Dredging Toxaphene Contaminated Sediments*. EPA also had begun studying toxaphene's effects on aquatic wildlife as evidenced by the 1960's data sheets from EPA's Environmental Research Center.

CESAS-OP-R
SUBJECT: TERRY CREEK DREDGE DISPOSAL SITE SUMMARY

In 1986, with a growing awareness of environmental concerns related to our activities, the Corps engaged the services of Savannah Labs to collect and analyze soil samples from the disposal area. We have enclosed both the report and data sheets from this study.

Steps were taken the last time we dredged in 1988/89 to protect workers from exposure and to provide for medical surveillance of Toxaphene.

In 1989, Hercules determined they would no longer be needing Terry Creek dredged. There were no other users of the channel at the time, and multiple users are required to justify continuance of that project, so it is possible they anticipated the Corps would likely cease its dredging operations in Terry Creek anyway.

Future plans for Terry Creek seem to be non-existent. It seems unlikely that anyone along the creek will request the Corps to dredge it again in the near future. However, just as it did after a 25-year lull in the 1950s and 1960s, the project could be revived again by the sudden change in industrial interests in the Brunswick Harbor/Terry Creek Area. For this reason, the Corps maintains its dredge disposal easements in perpetuity.

Attachment #4

HERCULES INCORPORATED

BRUNSWICK, GEORGIA 31520

July 12, 1971

Mr. Joe D. Tanner, Chairman
Coastal Marshlands Protection Agency
270 Washington Street, S. E.
Room 710
Atlanta, Georgia 30334

Dear Mr. Tanner:

Dredging of Terry Creek

This will confirm the essential points in our discussion of Friday, July 9, 1971 in which you with Colonel Dye reviewed the status of the Terry and DuPree Creek dredging with Messrs. Richard Scarlett, V. L. Nelson and me.

You indicated Governor Carter is very concerned about this work and he requested that you review it with me. Concensus of the Governor and the State Agencies involved, as well as the U. S. Army Corps of Engineers, is that the dredging be accomplished. During the past ten days you explored the possibility of using other forms of dredging equipment and alternate methods were not found to be applicable nor practical in this instance. The mode used by the Corps of Engineers, which was stopped by Governor Carter on June 13, 1971, was determined to be the most appropriate for this work. It was your opinion in your official capacity as State Game and Fish Commissioner and Chairman of the Coastal Marshlands Protection Agency, that the area north and east of the Terry-DuPree Creek waterway where the Corps of Engineers have existing easements and the land adjacent thereto was the location for the dredging spoil which would be least detrimental to the ecology of the area and acceptable to the State. The economic study conducted at your request by Dr. Robert Chaffin of Georgia State University determined the maintenance dredging of this waterway to be economically sound. We supplied information indicating the toxaphene level in the sludge dredged June 12, 1971 was approximately 30 to 35 ppm which is a very low level, much lower than the level upon which the Governor based his request to stop the dredging. This data can be verified through either Dr. Eugene Odum, Director of the Institute of Ecology, University of Georgia or Dr. Robert J. Riemold, Marine Institute at Sapelo Island.

It is our understanding from this discussion that the Corps of Engineers would be able to resume dredging of this waterway as soon as the property easements can be obtained north and east of Terry and DuPree Creek. This being so, we are advising the local landowners and the Corps of Engineers of your findings.

We are most willing to cooperate with the Governor, the State Agencies involved, you and the Corps of Engineers to get the dredging accomplished quickly.

Very truly yours,

MANAGER

HEHicks/nsh
cc: Governor James E. Carter
Col. H. L. Stroheker- Sav'h.,Ga.
Col. Harold Dye-Atlanta,Ga.

Cy to Ore Res Engr Real Estate Sav
cak 7/15/71

DIRECTOR

State Game & Fish Commission

TRINITY-WASHINGTON STREET BUILDING
270 WASHINGTON ST., S.W.
ATLANTA, GEORGIA 30334
PHONE: (404) 656-3504

July 19, 1971

→ EF: 006

POB

Mr. H. E. Hicks, Manager
Hercules, Incorporated
Brunswick, Georgia 31520

Dear Mr. Hicks:

This will acknowledge your letter of July 12, 1971 with copies to Governor Carter, Colonel Strohecker and Colonel Dye.

Mr. Jack Crockford of my department called you on July 1st to advise you that we have not agreed on a number of points made in your letter including the selection of spoil sites. Frankly, Colonel Dye and I are somewhat confused over your analysis of our visit of July 9th. Under any conditions, as a result of Mr. Crockford's call, our visit on July 16th and this letter, I am certain we can proceed aggressively without further confusion.

We do agree that the dredging of Terry Creek be accomplished providing spoil sites acceptable to the state from an environmental standpoint can be obtained. We have reviewed several possibilities with the Corp, and we will continue to review the area north and east of Terry Creek but we do not agree at this time on the selection of this site.

The economic study conducted by Dr. Robert Chaffin did show an acceptable benefit-cost ratio based on Hercules figures and not including environmental economic consideration.

The Georgia Water Quality Control Board has a complete file on the Terry Creek pollution as well as up to date information on the toxaphene levels. The toxaphene level in the spoil at the mouth of Terry Creek would not be indicative of the toxaphene levels in the upper reaches of Terry Creek.

Copy furnished
Nac PB
Exc Engr
RE P+S

The Army Corp of Engineers has advised the Governor by letter that it is not economically feasible to return the dredge Arlington to Terry Creek under this contract. We are advised that the dredging can be resumed in April or May of 1972.

As we discussed, it is essential that the state, the Corp and Hercules work closely together in resolving this matter. The Marshlands Protection Agency will aggressively seek a fair and equitable solution.

We appreciate your pledge of cooperation.

Very truly yours,

Joe D. Tanner
Director

JDT:es

cc: Governor Jimmy Carter
Colonel Howard L. Strohecker
Colonel Harold Dye

HERCULES INCORPORATED

BRUNSWICK, GEORGIA 31520

July 23, 1971

Colonel Howard L. Strohecker
Corps of Engineers
District Engineer, Savannah District
P.O. Box 889
Savannah, Georgia 31402

Attention Mr. T. V. Dye

Dear Sir:

Terry Creek Navigation Project - Brunswick Harbor

In order to assist you in the selection of a possible alternate spoils area in compliance with Governor Jimmy Carter's request, we have attached a marked map (BNS-1885) which contains information which may be useful in your investigation. Principle members of the companies which own these properties have verbally indicated a willingness to provide easements where necessary for placing this spoil.

It is our understanding that a spoil area of approximately 150 acres would be required to accommodate the spoil from dredging Terry and DuPree Creeks to Corp Project Specifications. An area this size could easily be located within the two areas enclosed in yellow on the map.

The owner's of record of the plots shown are as follows:

Plot No. 1 - (The L. T. DuPree Tract)

a) 4/5th undivided interest (112 Acres) owned by the Altama Co., Mr. Harold L. Friedman, Director, Brunswick, Georgia.

b) 1/5th undivided interest (28 Acres) owned by Hercules Inc., Harold E. Hicks, Manager.

Plot No. 2 (358 Acres) Wholly owned by the Riverside Development Co., Partners:

Mr. Charles Elzey, Brunswick, Georgia
Mr. Ernest Nutt, Brunswick, Georgia
Mr. Euclid Lewis, Brunswick, Georgia

Mr. Willie B. Lewis, Brunswick, Georgia
Mr. Roy Smith, Brunswick, Georgia
Mr. Herman Scott, Atlanta, Georgia

In order to resolve this unfortunate interruption to this dredging project, Hercules will work with the Corp of Engineers in any way possible to have your dredge return to this area.

Yours truly,

HERCULES INCORPORATED

Walter J. Young

W. J. Young
Supervising Engineer

WJY/mjm

Attach.

HERCULES

Brunswick, Georgia
December 2, 1971

S. Fenelon - P&PC, WILMINGTON

H. E. Hicks

TERRY-DUPREE CREEK DREDGING -
MEETING WITH U. S. CORPS OF ENGINEERS, DECEMBER 2, 1971

A meeting was arranged with Col. Howard L. Strohecker, District Engineer, U. S. Army Corps of Engineers, at Savannah for today. Present at the meeting were the following persons: Col. Howard L. Strohecker, District Engineer; Mr. Joseph F. Frewer, Chief, Operations Division; Mr. Albert D. Woodle, Jr., Chief, Real Estate Division; Mr. W. Kelly Mims, Realty Officer; Mr. Clarence C. Brown, Chief, Planning Branch; Mr. John W. Harris, Chief, Navigation Section; Mr. C. M. Ellzey, President, Riverside Corporation; Mr. P. T. Newton, Vice President-General Manager, Dixie-O'Brien Corporation; Mr. V. L. Nelson, Assistant Plant Manager; Mr. W. H. Etheridge, Plant Engineer; and myself.

The purpose of the meeting was to ascertain the status of preparation for dredging the Terry-DuPree Creek waterway by the U. S. Army Corps Engineers to determine potential obstacles or problems associated with this in which we might be helpful so as to expedite the completion of this work.

During the discussion, it was apparent that the State of Georgia and its agencies had removed their initial objections to the dredging operation and had given full clearance for the Corps to proceed with the dredging operation. The Corps of Engineers are obliged to work through the local assurers; namely, the Board of Commissioners of Glynn County, the City of Brunswick, and the Brunswick Port Authority. The local assurers are to assist in obtaining property easements for the placement of dredging spoil upon sites predetermined by the Coastal Marshlands Protection Agency for this purpose. The sites are defined on the Brunswick Harbor real estate project map Segment "I", the applicable portion of which is attached for reference. Easements for parcels E-1 and E-2, currently owned by Riverside Development Company, need to be finalized. Easements for Areas 3 and 4 are already on record with the Corps of Engineers.

According to Colonel Strohecker, the local assurers are to provide dikes around the perimeter of the selected areas for spoil disposal, the dike height to be 12 feet above mean low water. This work could proceed immediately on Areas 3 and 4, and following the obtainment of easements, on Areas E-1 and E-2. The dikes are to meet standards acceptable to the Corps, which, in turn, would be acceptable to the Coastal Marshlands Protection Agency. We inquired as to the approximate cost of dike preparation and no dollar figure was ventured; however, from the Corps' experience, a dragline might accomplish 100 feet of dike per day.

The quantity of spoil to be accommodated or removed from the Terry-DuPree Creek waterway was estimated to be approximately 600,000 cubic yards, equivalent to approximately 450 acres at a 1-foot depth.

According to Colonel Strohecker, the J. A. Laporte Dredging Company of Norfolk, Virginia, has a dredge locally available and anxious to proceed with the dredging of this waterway. The contract for the dredging is still open and valid.

A representative of the Corps of Engineers was to communicate today with the local assurers, presumably Mr. Ed Hulse, to validate rights and obtain the necessary support and assistance for this work.

I reiterated our concern for the completion of this work and our status as a non-participant in the actual, necessary involvement with the project. We indicated further that we would be glad to assist as a catalyst or in other ways to help keep the work progressing as expeditiously as possible. Colonel Strohecker appeared to be in full support of this project, and I feel sure he desires to complete it as quickly as possible.

HEH/bha

Attachment

cc: F. K. Lane - P&PC, Wilmington
Col. H. L. Strohecker - Corps of Engineers
P. T. Newton - Dixie-O'Brien Corporation
C. M. Ellzey - Riverside Corporation (5)
H. J. Friedman - Altama Company (5)
J. E. Hulse - City of Brunswick
R. J. Boyd - Glynn County Commissioners
I. M. Aiken, Sr. - Brunswick Port Authority
V. L. Nelson
W. H. Etheridge

HERCULES INCORPORATED

BRUNSWICK, GEORGIA 31520

January 20, 1972

Mr. Joe D. Tanner, Chairman
State of Georgia
Coastal Marshlands Protection Agency
270 Washington Street, S. W.
Room 710
Atlanta, Georgia 30334

Dear Joe:

TERRY-DUPREE CREEK WATERWAY

The Terry-DuPree Creek dredging program has encountered a number of obstacles which have seriously delayed action to provide a channel adequate for barge traffic.

Time is important. The need for an easily navigable channel is now. Even starting now with the diking, it would be several months before the U. S. Army Corps of Engineers could dredge and be in compliance with the Water Quality restrictions. The Corps of Engineers is ready and willing to return to this job but cannot until all the necessary preliminary preparations are accomplished. It is urgent that action be taken immediately because the original contract for the dredging is still open and the dredge is available. According to Mr. J. F. Frewer, chief of the Savannah District Operations office, the dredge will complete its work in this area about April, and if it cannot move directly to Terry Creek, the existing contract would have to be cancelled. This would, indeed, be unfortunate.

We have one problem with which you can assist us; that is, the spoil area. Riverside Corporation has reviewed its land use plans and has chosen to develop area E-1 for residential development (see attachment) and is reluctant to grant a permanent spoil easement for Area E-2 because of its future potential to them. Therefore, an alternate spoil site must be selected. Would you please have your staff review other possible nearby areas and approve an alternate site for spoil disposal.

Actually, our Company and myself, are in a rather awkward position. We are concerned for the prompt completion of this project, but in our status as a nonparticipant, we can serve only as a catalyst to assist both the U. S. Army Corps of Engineers and the local and state agencies to move forward with the work as expeditiously as possible.

1522.01 Brunswick Harbor, Terry Creek

HERCULES

Your assistance will be appreciated.

Very truly yours,

H E Hicks

Manager

H.E.Hicks/bha

Attachment: Department of the Army, Real Estate Map, Segment "I", Brunswick Harbor.

cc: Mr. Stanley Fenelon - P&PC, Wilm.*
Mr. T. E. Powers - P&PC, Wilm.
Mr. F. K. Lane - P&PC, Wilm.*
Col. H. L. Strohecker - U. S. Army Corps of Engineers*
Mr. J. E. Hulse, Manager - City of Brunswick*
Mr. C. A. Taylor, Jr., Mayor - City of Brunswick
Mr. R. J. Boyd - Glynn County Commissioners*
Mr. H. H. Baer - County Administrator & Clerk
Mr. I. M. Aiken, Sr. - Brunswick Port Authority*
Mr. P. T. Newton - Dixie-O'Brien Corporation*
Mr. C. M. Ellzey - Riverside Corporation (5)*
Mr. H. J. Friedman - Altama Company (5)*
Mr. V. L. Nelson*
Mr. W. H. Etheridge*

*Attachment previously furnished with December 2, 1971 memo.

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office

REFERENCE OR OFFICE SYMBOL	SUBJECT
SASNN	Resume of Contact with Individuals Outside District Office

	FROM	DATE	CMT 1
THRU Chief, Planning Br Chief, Eng Div	Ch, Navigation Sec	26 Jan 72 Mr. Harris/cht/ext. 268	

TO District Engineer

1. Date: 24 January 1972

   Time: 1500

   Place: Real Estate Div

2. Name of individual and organization contacted:
   Mr. Hicks - Hercules Corp., Brunswick, attorney

3. District personnel involved:
   Mr. Mims and Mr. Morton - Acquisition Branch, RE
   Mr. William Young and Mr. J. W. Harris - Navigation Sec, PB

4. Resume of contact:

a. Mr. Hicks advised that they had been unable to acquire spoil easements from Mr. Elzy; also, the easement on a portion of Area 1 has expired.

b. He asked would Area 1 be large enough for dredging only to Hercules Dock? The answer is no because it would not be possible to construct dikes high enough in the short time that is available. It was suggested that 140 acres of spoil area would probably be adequate for 400,000 c.y. from Terry Creek. The total excavation is about 600,000 c.y. The remaining work might be postponed if agreeable to all concerned. It would require negotiation with the contractor. They were advised that any changes in the recommended plan using areas 1, 2, and 3 should be proposed by them and have concurrence of Joe Tanner.

c. The pending requirement to provide settlement of solids was discussed, advising that spoil area capacity should be three to four times the volume to be dredged.

d. Dikes should be completed within 2 months if LaPorte is to do it under his present contract. Otherwise it will probably be necessary to readvertise the work next year subject to the availability of funds.

HARRIS

SAS FL 312A
14 Jun 71

1522-01
Brunswick
Jetty Co

MEMO FROM
ROBERT J. REIMOLD
THE UNIVERSITY OF GEORGIA
MARINE INSTITUTE
SAPELO ISLAND, GEORGIA 31327
912/485-2312

Attachment # 5

30 March 1973

Mr. Johnny Harris:

Enclosed is a draft of a manuscript we wish to submit to the Pesticide Monitoring Journal. Kindly critically review the manuscript and advise me of suggested improvements. I will appreciate your prompt reply.

Thanks again to you and the Corps for the support you provided for this research.

R J Reimold

Toxaphene content of estuarine fauna and flora before, during, and after dredging toxaphene contaminated sediments.[1]

Robert J. Reimold and Charles J. Durant

[1]Contribution No. xxx from the University of Georgia Marine Institute, Sapelo Island, Georgia 31327

Abstract

This paper evaluates the concentations of toxaphene found in selected estuarine fauna, flora, sediment, and dredge spoil prior to, during and after the dredging of Terry Creek, Brunswick, Georgia. This creek receives the effluent from a nearby toxaphene manufacturing plant. Toxaphene content was higher during dredging (than before or after) in dredge spoil and fauna and flora. Oysters, reported to be among the best biological monitors, did not demonstrate large changes in toxaphene content. The best indicators evaluated were *Spartina alterniflora* and *Fundulus heterioclitus*. Although the dredging operations did result in increases in toxaphene content of fauna and flora, no direct results of this increased pollution load were assessed.

Introduction

Environmental contamination by pesticides may have far-reaching effects. A unique occasion to study the dispersal of the chlorinated hydrocarbon, toxaphene, and its relation to waterway maintenance dredging arose near Brunswick, Georgia. Terry Creek, which receives the effluent from a toxaphene manufacturing plant, was the site of a recent dredging operation. Baseline studies of the pesticide concentration in this estuarine ecosystem have been documented by Durant and Reimold (1972). Toxaphene was frequently found in many portions of the estuarine food web and was highly concentrated in the sediments of Terry Creek.

Prior to the commencement of dredging operations, a monitoring program was outlined at the request of the U. S. Army Corps of Engineers, Savannah District. The purpose of this was to evaluate toxaphene concentrations in selected estuarine fauna, flora, sediment, and dredge spoil during the dredging of Terry Creek. The study was designed to document (at weekly intervals) the possible role of toxaphene in any resulting disturbance to the balance of nature within the Terry Creek Estuary.

Methods

The dredging of Terry Creek was conducted by hydraulic pumping and 6×10^5 ~~Sand~~ cubic yards of spoil was placed in two diked areas on a nearby salt marsh (Figure 1). Collection sites for environmental samples included: A) Back River Bridge; B) mouth of Terry Creek; C) eastern dredge spoil area (near Back River); D) western dredge spoil area; E) main channel of Terry Creek. Field collections were obtained at weekly intervals

beginning one week prior to the beginning of dredging operations, and terminating eight weeks later (one week after the completion of all dredging). Additional baseline data on toxaphene content of Terry Creek organisms were collected during 1970 and 1971, and follow-up collections continued at monthly intervals for several months. Environmental samples included: finfish collected by otter trawl and cast net in the main channel of Terry Creek; Spartina alterniflora (saltmarsh cordgrass) collected from near the dredge spoil diked areas; sediment collected from the mouth of Terry Creek and from within each of the diked spoil areas; and oysters (Crassostrea virginica) collected from the Back River Bridge.

The samples were processed and analyzed for toxaphene according to the techniques of Durant and Reimold (1972) and Wilson (1967). All concentrations are expressed in parts per million (ppm) on a wet weight basis except Spartina alterniflora which is dry weight. The relative recovery from oysters and sediment was above 85% and 90% respectively. Data are not corrected for this error and concentrations below 0.25 ppm were considered insignificant with the exception of that included in water samples.

Results

The results of toxaphene analyses in fauna, flora, and sediment (Table 1) reveal that toxaphene was higher in dredge spoil sediment than in any other samples processed. Comparisons of concentrations in fish, shrimp, marsh grass, and sediment (Figures 2 through 10) show that, except for dredge spoil within the diked areas, concentrations rarely exceeded 10 ppm.

The best biological monitors, shellfish, did not concentrate significant quantities of toxaphene. Butler (1969) demonstrated that shellfish can produce biological magnification of pesticides (up to 70,000 times that of surrounding water). Levels in oysters collected adjacent to the mouth of Terry Creek (Back River Bridge, Figure 1) never exceeded 2.0 ppm during the entire dredging operation.

Concentrations of toxaphene in dredge spoil (Figures 4 and 5) neared one part per thousand. This highly contaminated sediment was held inside the two diked areas (Figure 1) and did not appear to influence the surrounding biota.

Background toxaphene concentrations from 1970-1971 collections exhibit higher values than those found in 1971-1972 collections. This reflects in part the pollution abatement practices initiated at the toxaphene production plant which greatly decreased the quantities of toxaphene in the plant effluent. Most of the 1971-1972 values are similar to concentrations found week 1, i.e. one week prior to dredging operations.

Discussion

The toxaphene concentration appears to be best indicated in the Spartina. The various species of fish are also good indicators of the increased toxaphene in the suspended material and water. Although Butler (1969) has suggested osyters to be among the best biological monitors for pesticide residues in estuarine waters, the results of this study suggest the marsh grass, Spartina, and the finfish to be the best indicators of toxaphene concentration. We submit that different organisms may be able to preferentially concentrate different residues.

The results also document the relatively low levels of toxaphene in the fauna, flora and sediments prior to initiation of the dredging operations. These data related to toxaphene content and pre-dredging conditions agree with that reported for the same area in the two-year period preceding this study (Durant and Reimold, 1972 and Reimold and Durant, 1972). The data also reveal increases in toxaphene content in organisms, sediment and dredge spoil during dredging operations.

Altogether, over 125 samples were analyzed for toxaphene during the eight week study. In addition, qualitative visual examination of the Terry Creek area was made at weekly intervals to assess potential fish kill. Very few dead fish were recovered (< 20) during the eight 4 to 5 hour collection trips. Those recovered and positively identified included tonguefish, harvest fish, silver perch, sea catfish, and one menhaden. Since local shrimp boats that dock in Terry Creek were frequently landing and sorting their catches during the study, it is probable that this may have been the source of dead fish, especially since our sampling did not indicate the species to be indigenous to Terry Creek. At no time were fish observed to be dying, alive but floating on the surface on their sides, or showing any other signs of distress during the nearly one hundred man-hours of field sampling in Terry Creek.

It is our conclusion that dredging of Terry Creek greatly enhanced the biological productivity of the estuary by isolating the toxic materials in the diked enclosures. A combination of ultraviolet radiation and biological degradation should render the impounded sediments nontoxic in a few years.

Literature Cited

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Durant, C. J. and R. J. Reimold. 1972. Effects of estuarine dredging of toxaphene contaminated sediments in Terry Creek, Brunswick, Ga. - 1971. Pesticide Monitoring Journal 6(2):94-96.

Reimold, R. J. and C. J. Durant. 1972. Survey of toxaphene levels in Georgia estuaries. Georgia Marine Science Center, Technical Report Series Number 72-2. Skidaway Island, Georgia.

Wilson, A. J., Jr. 1967. Pesticide analytical manual for BCF contracting agencies. U. S. Bur. Commer. Fish. Gulf Breeze, Fla. 1-11 pp.

Acknowledgments

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9 June 1971

Subject: Sampling in Terry Creek.

Samples were taken at 3 locations in Terry Creek on 9 June 1971 by the Survey Party. A sampler borrowed from the Skidaway Institute was used.

(2) The samples were stored in the freezing compartment of the refrigerator located in the Car Pool garage.

(3) No analyses will be made at the present time, but will be held for analyses of "Before Dredging" conditions if any questions or problems arise AFTER the dredging in Terry Creek has been completed.

SASNN

Terry Creek - Maintenance Dredging

xxTHRU Ch, Environmental Resources Sec

Ch, Navigation Sec

27 May 1971
Mr. Harris/cht/ext. 268

TO Ch, Planning Br

1. It is planned to take some water samples in Terry Creek before the scheduled dredging is performed which will serve as background data in case some problem should develop. Samples will also be taken during the dredging to provide means of observing the effect of dredging in this location. It is also planned to take photographs of the spoil areas before and after dredging, from a local citizen's point of view from the highway. The basic complaint was relative to the disposal of material adjacent to the highway. The photographs would show the effect of the disposal of material in this aspect.

2. The effect of the dredging should be evaluated in terms of D.O., temperature, suspended sediment, and turbidity; and it would be desirable to have low-water and high-water observations. It is estimated that 2 days' sampling will be required before dredging and 2 days' during dredging, and probably one day's after dredging is completed if the samples taken during dredging indicate a need.

3. Sampling will be performed by ENV personnel and work will be charged to 9311041-607200-10.

HARRIS

Table 1. Summary of data collected during fall 1972 monitoring of Terry Creek dredging operation. Values expressed are toxaphene concentrations (PPM). NSC = no sample collected; NAS = not adequate sample; ND = not detectable.

	Replicate No.	Cruise No. 1 2 Sept	Cruise No. 2 14 Sept	Cruise No. 3 21 Sept	Cruise No. 4 28 Sept	Cruise No. 5 5 Oct	Cruise No. 6 12 Oct	Cruise No. 7 19 Oct	Cruise No. 8 26 Oct
Fundulus heteroclitus (Killifish)	1	10.45	NSC	NSC	10.52	NSC	131.14	12.07	NSC
Fundulus heteroclitus (Killifish)	2	8.97	NSC	NSC	3.41	NSC	217.14	5.18	NSC
Spartina (salt marsh cordgrass)	1	0.82	1.13	0.73	2.04	.81	3.93	7.33	1.69
Spartina (salt marsh cordgrass)	2	0.76	1.56	0.56	2.54	.91	3.68	6.26	2.92
Crassostrea (Eastern oyster)	1	1.20	1.42	1.55	1.21	1.26	1.19	1.70	(
Crassostrea (Eastern oyster)	2	1.37	1.33	1.71	1.15	1.23	1.24	1.79	0.95
Sediment (near entrance to Terry Creek)	1	5.47	5.56	0.87	2.11	5.55	3.97	2.11	2.64
Sediment (near entrance to Terry Creek)	2	4.42	4.20	0.94	2.68	7.24	4.06	2.23	3.74
Dredge spoil from east enclosure (Back R.)	1	NSC	0.81	60.08	5.70	NSC	NSC	NSC	NSC
Dredge spoil from east enclosure (Back R.)	2	NSC	0.79	150.79	5.12	NSC	NSC	NSC	NSC
Dredge spoil from west enclosure (Dupree C.)	1	NSC	NSC	NSC	NSC	93.39	756.40	51.64	241.64
Dredge spoil from west enclosure (Dupree C.)	2	NSC	NSC	NSC	NSC	119.52	812.64	142.42	331.55
Water sample	1	ND	NSC	0.0013	0.0013	0.0016	0.0014	NSC	NSC
Water sample	2	ND	NSC	NAS	NAS	NAS	NAS	NSC	NSC
Anchoa (anchovy)	1	NSC	8.61	NSC	20.46	8.96	9.89	12.85	10.51
Anchoa (anchovy)	2	NSC	NAS	NSC	16.60	NAS	10.13	11.96	NAS
Penaeus (shrimp) head and thorax	1	NSC	1.21	4.80	3.22	3.03	2.88	4.19	10.69
Penaeus (shrimp) head and thorax	2	NSC	1.51	4.65	2.24	2.85	NAS	4.30	7 1
Penaeus (shrimp) abdomen (edible tail)	1	NSC	0.58	0.86	1.22	0.92	1.49	0.74	2.51
Penaeus (shrimp) abdomen (edible tail)	2	NSC	0.58	0.90	0.88	0.73	NAS	0.64	0.83
Stellifer (star drum)	1	NSC	2.43	2.09	NSC	2.72	NSC	NSC	1.42
Stellifer (star drum)	2	NSC	2.61	3.24	NSC	2.48	NSC	NSC	1.09

DREDGING — BEGINS — 7 September 1972 — DREDGING — ENDS — 20 October 1972

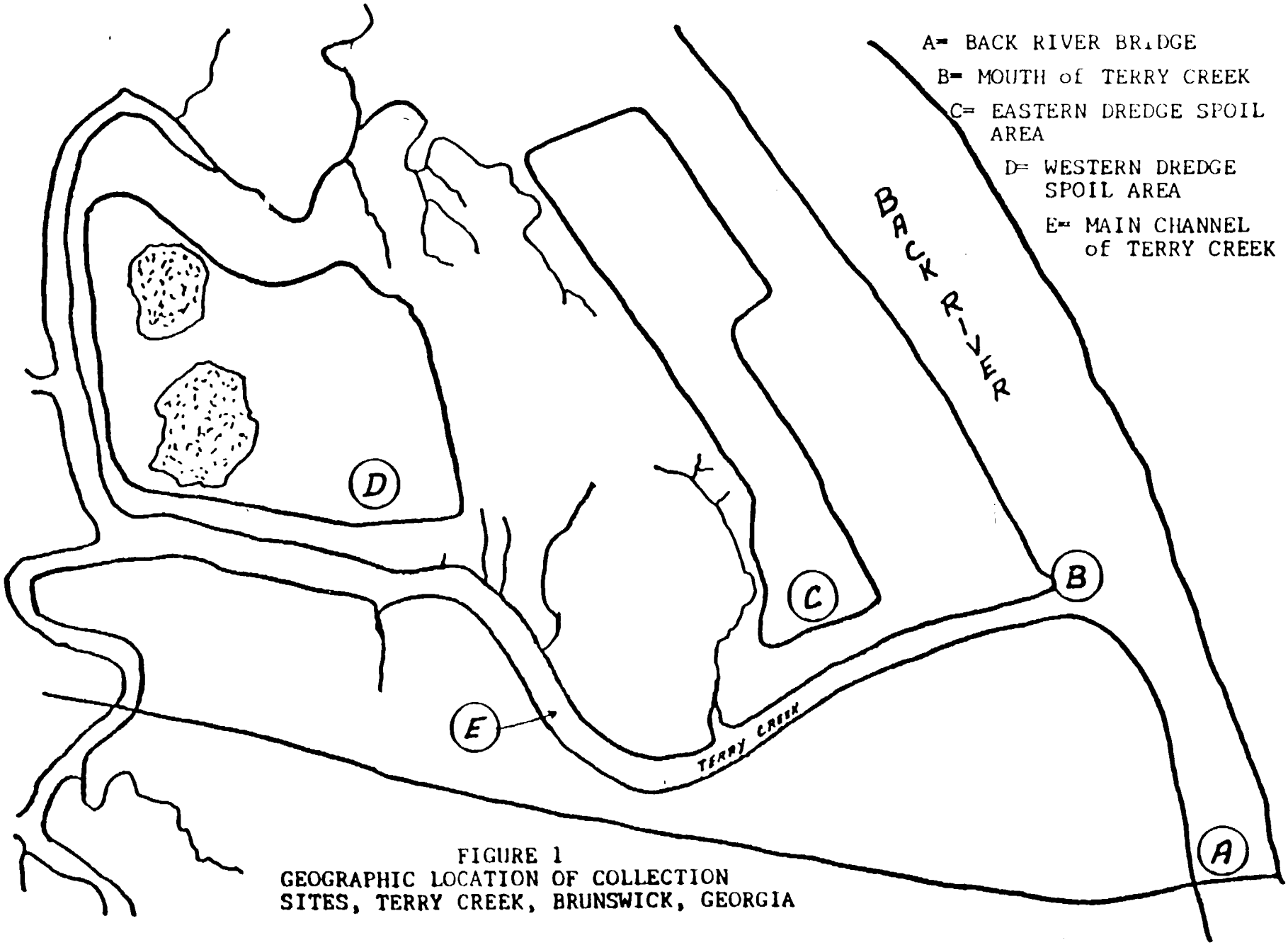


FIGURE 1
GEOGRAPHIC LOCATION OF COLLECTION SITES, TERRY CREEK, BRUNSWICK, GEORGIA

FIGURE 2

TOXAPHENE CONCENTRATIONS IN CRASSOSTREA VIRGINICA FROM BACK RIVER BRIDGE PPM

(DOUBLE BARS INDICATE REPLICATE SAMPLES. 70-71 = MEAN OF 18 SAMPLES COLLECTED 1970-1971, 71-72 = MEAN OF 14 SAMPLES COLLECTED DURING 1971-1972.)

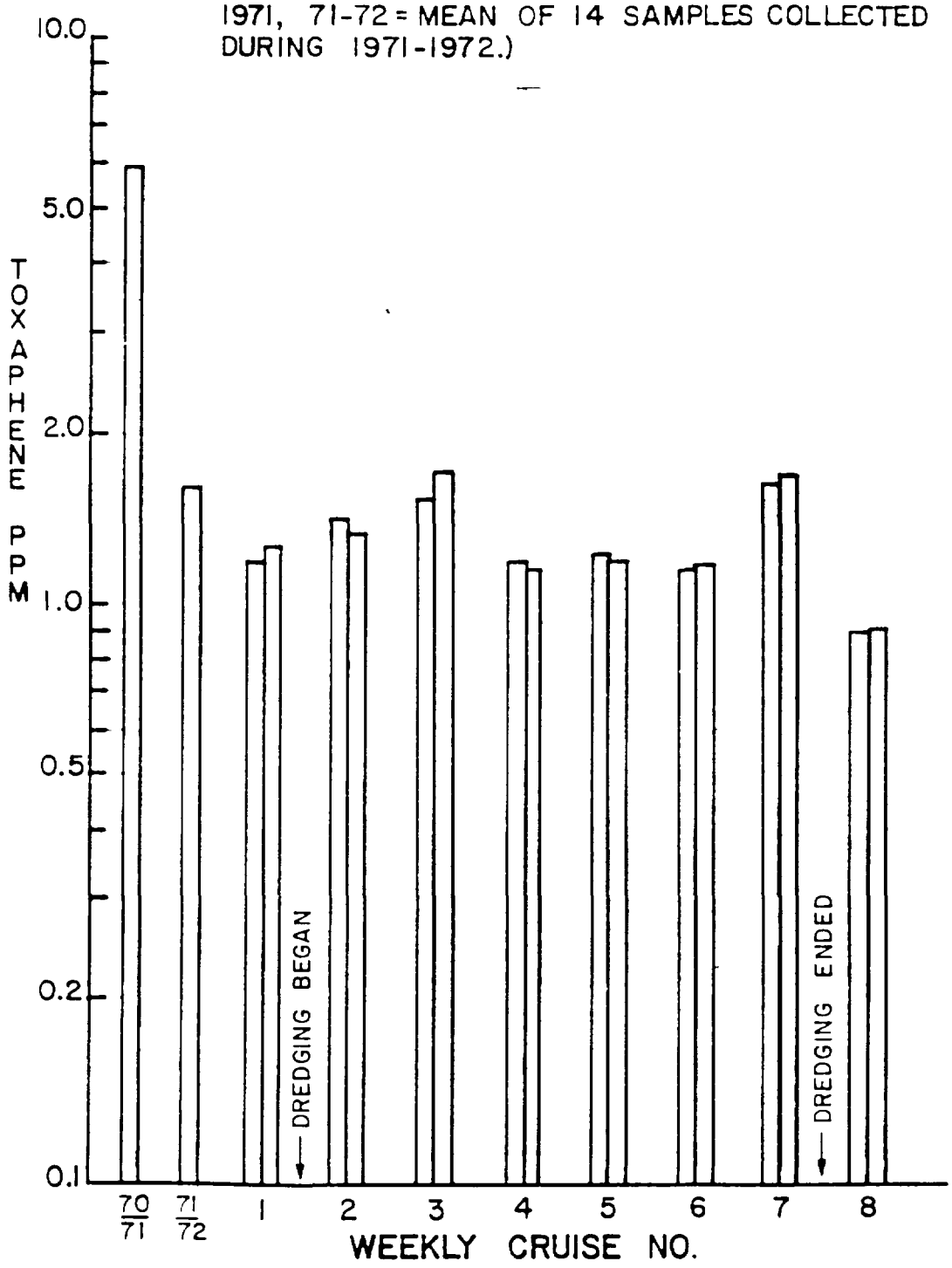


FIGURE 3

TOXAPHENE CONCENTRATIONS IN SURFACE SEDIMENT FROM MOUTH OF TERRY CREEK PPM

(DOUBLE BARS INDICATE REPLICATE SAMPLES)

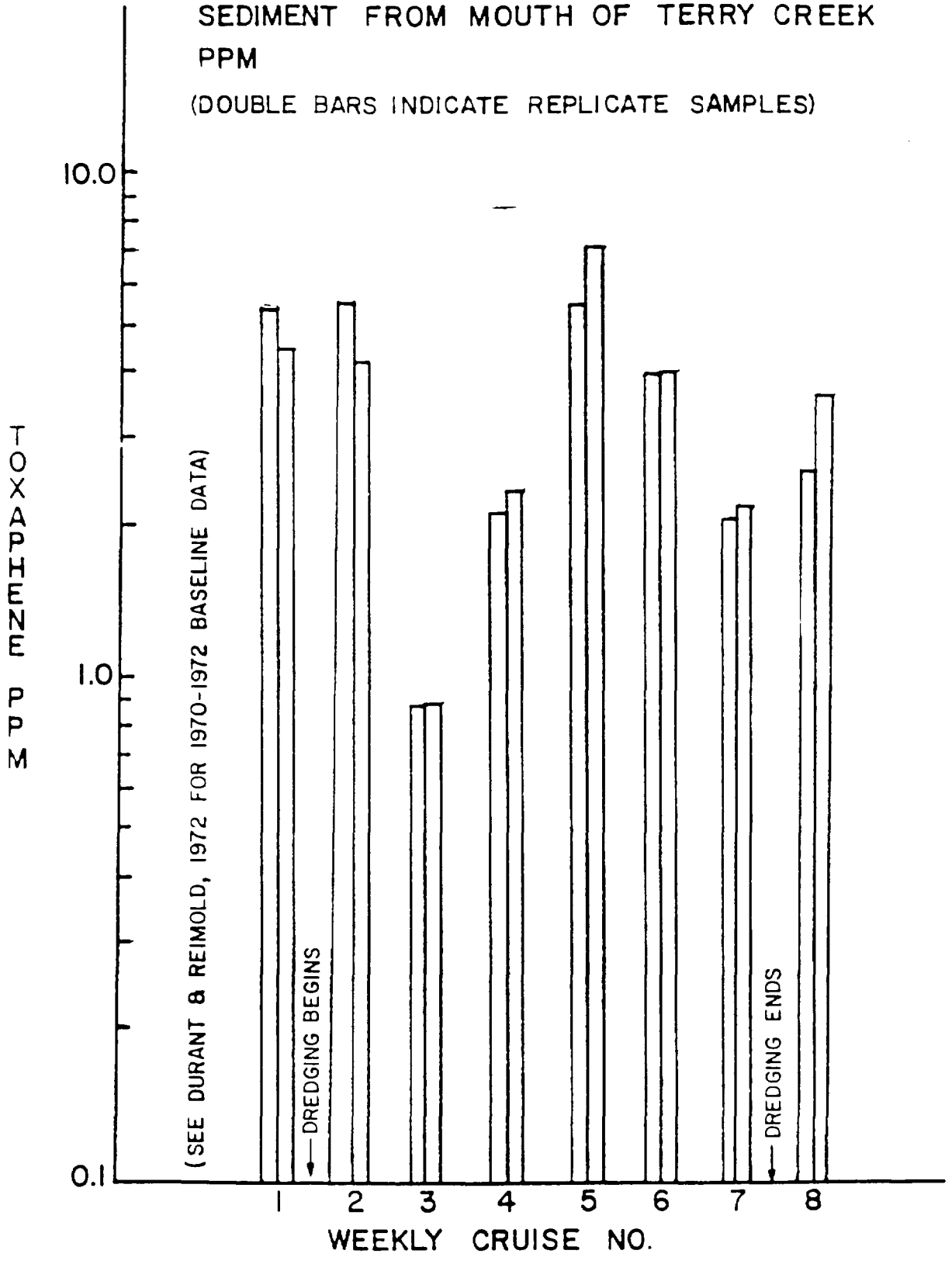
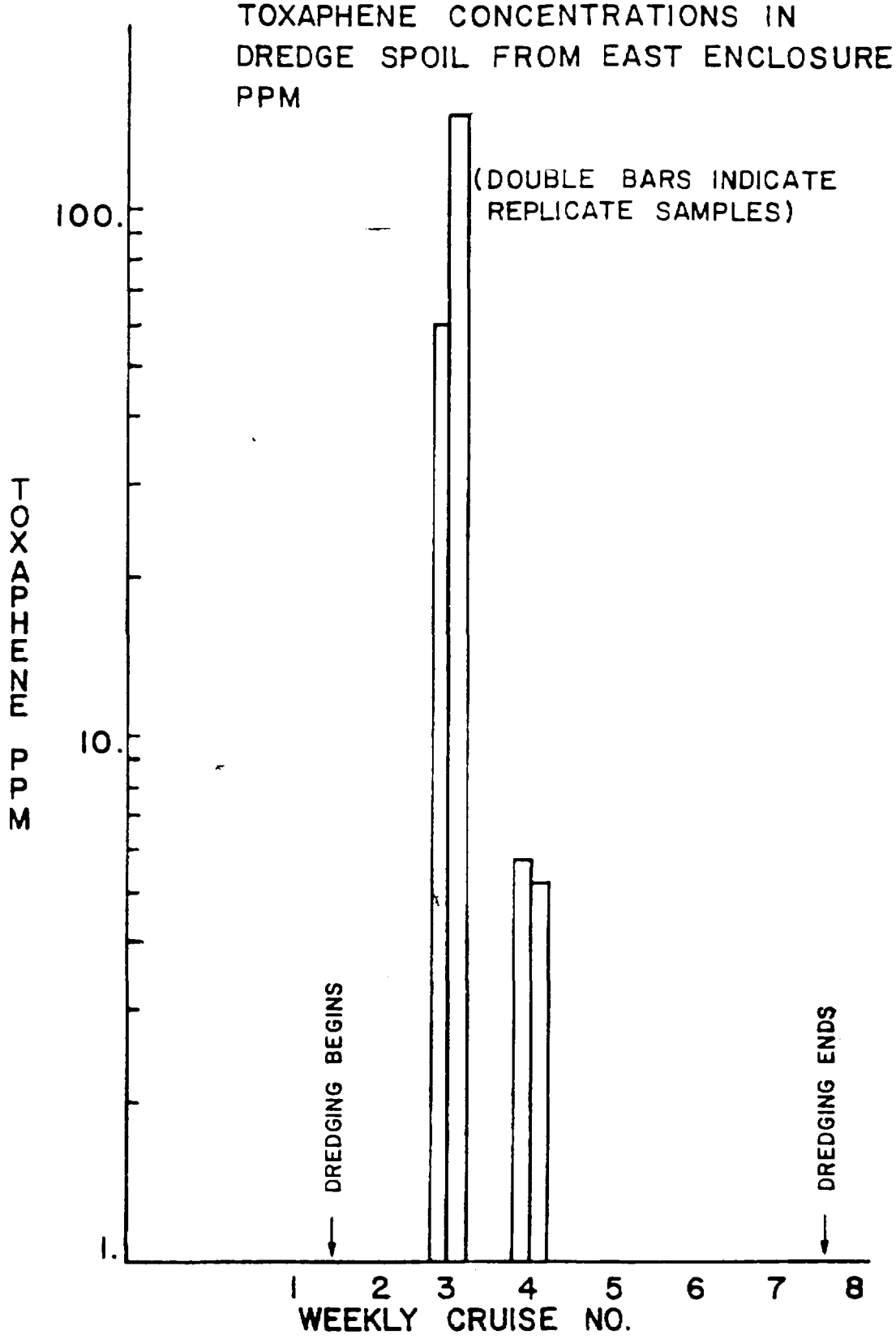


FIGURE 4


TOXAPHENE CONCENTRATIONS IN
DREDGE SPOIL FROM EAST ENCLOSURE
PPM
(DOUBLE BARS INDICATE
REPLICATE SAMPLES)
100.
10.
1.
TOXAPHENE PPM
DREDGING BEGINS
DREDGING ENDS
1
2
3
4
5
6
7
8
WEEKLY CRUISE NO.

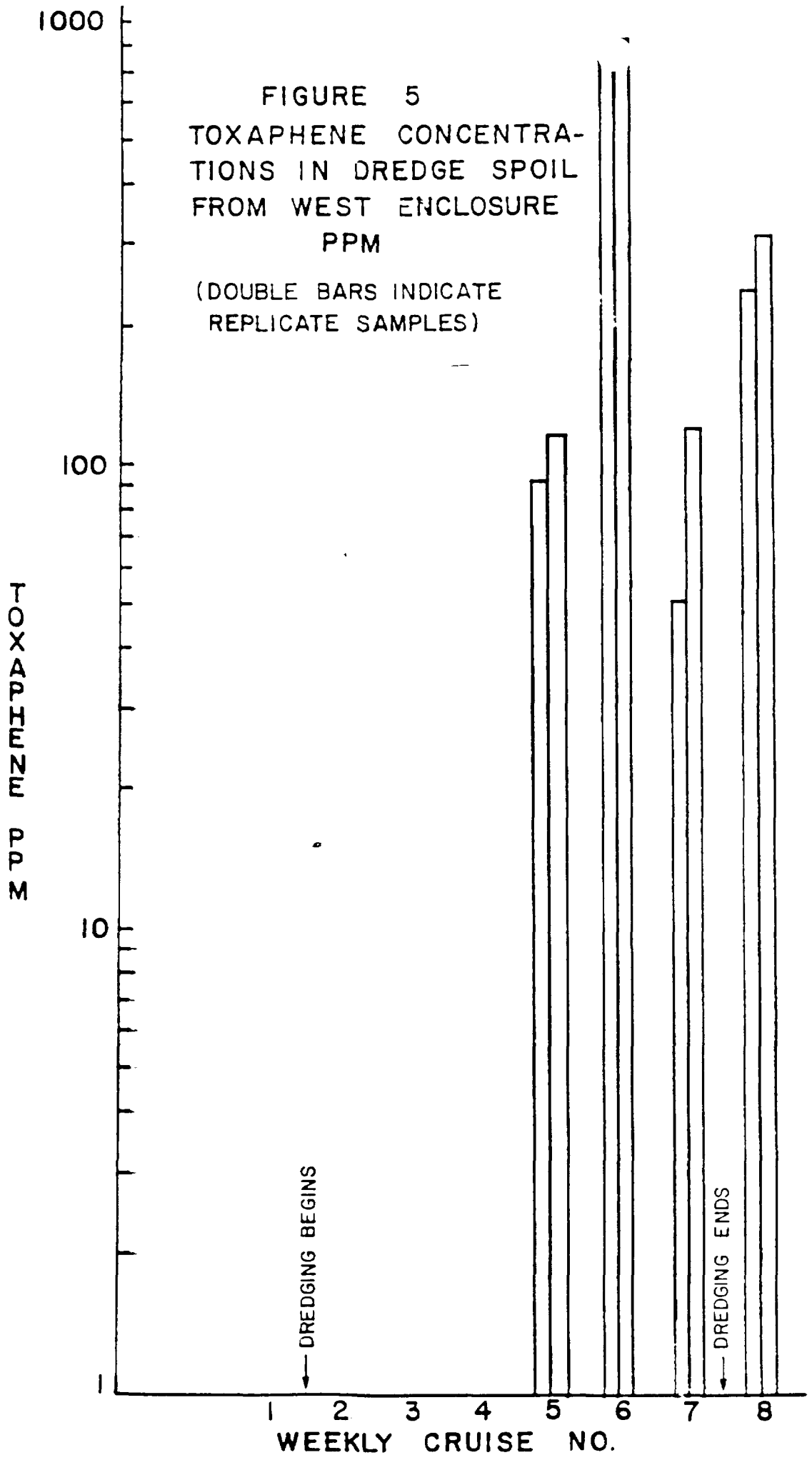
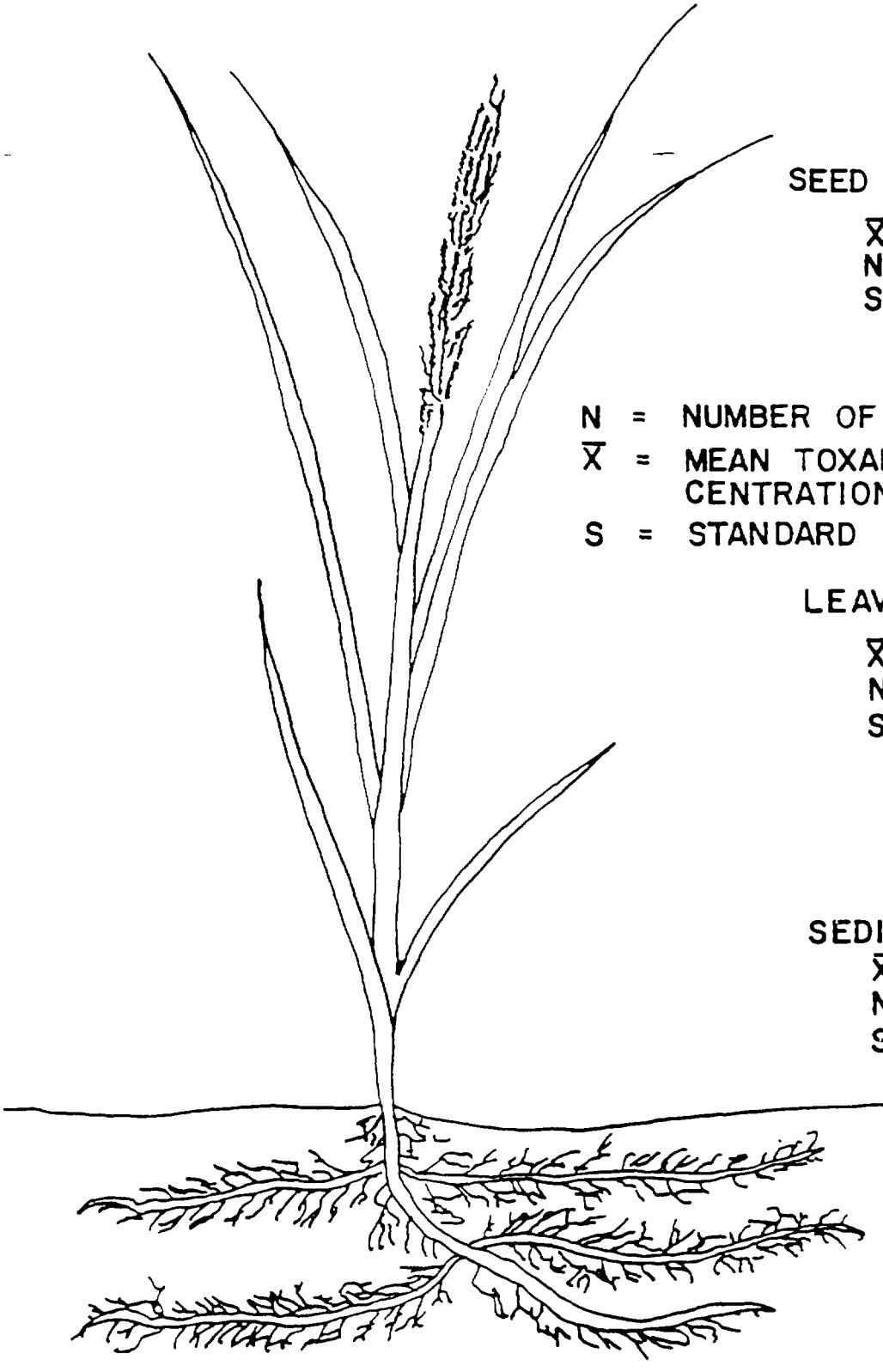


FIGURE 5
TOXAPHENE CONCENTRATIONS IN DREDGE SPOIL FROM WEST ENCLOSURE PPM

(DOUBLE BARS INDICATE REPLICATE SAMPLES)

FIGURE 6

CONCENTRATION OF TOXAPHENE (IN PARTS PER MILLION) IN SPARTINA ALTERNIFLORA AND SURROUNDING SEDIMENTS COLLECTED FROM TERRY CREEK MARSH (1970-1972)



SEED HEADS

$\bar{X}$ = 4.93
N = 2
S = 1.92

N = NUMBER OF OBSERVATIONS
$\bar{X}$ = MEAN TOXAPHENE CONCENTRATION
S = STANDARD DEVIATION

LEAVES

$\bar{X}$ = 36.30
N = 10
S = 4.51

SEDIMENT

$\bar{X}$ = 32.56
N = 4
S = 22.15

ROOTS

$\bar{X}$ = 1.91
N = 1

RHIZOMES

$\bar{X}$ = 1.24
N = 1

FIGURE 7

TOXAPHENE CONCENTRATIONS OF SPARTINA ALTERNIFLORA FROM BANK OF BACK RIVER PPM

(DOUBLE BARS INDICATE REPLICATE SAMPLES)

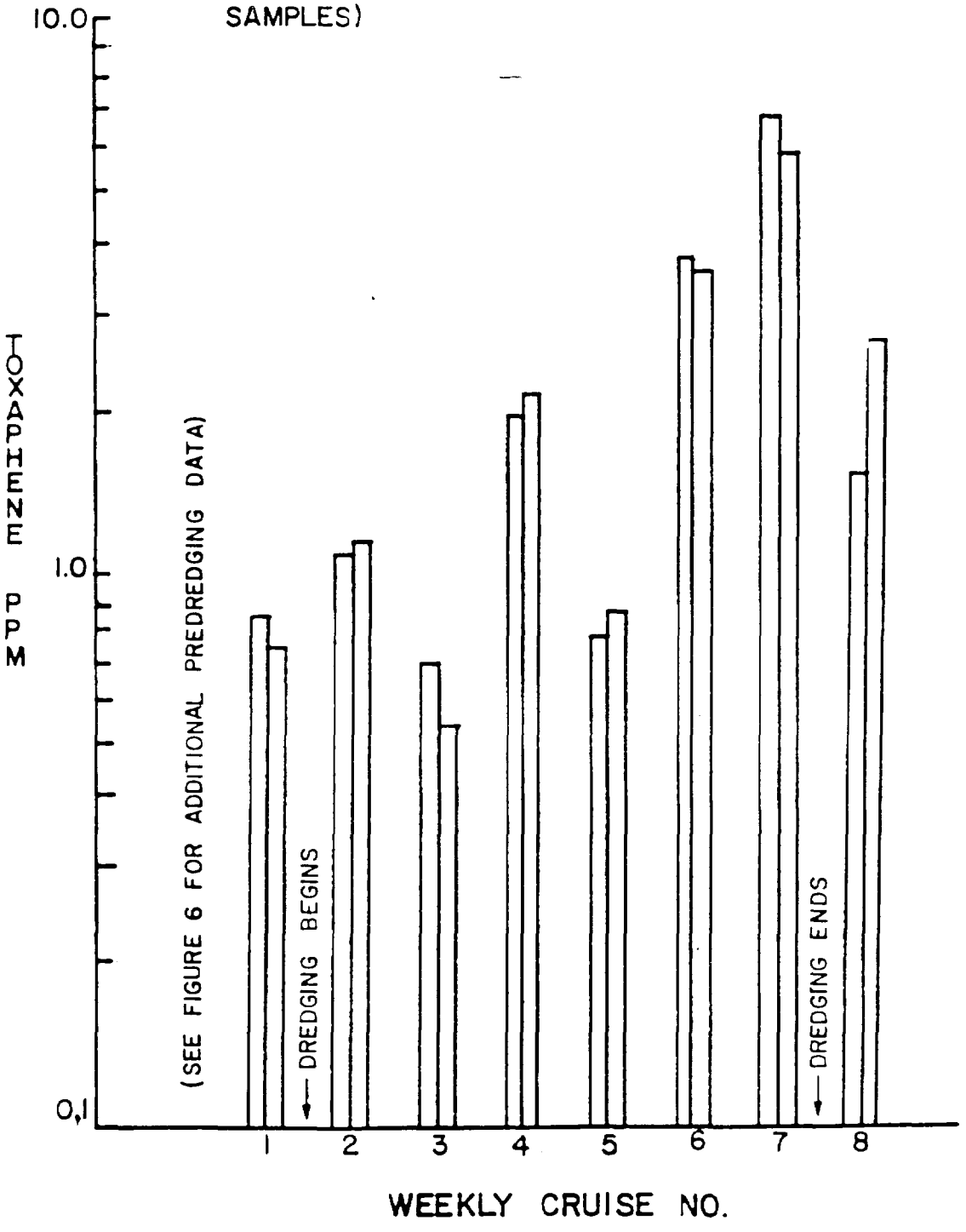


FIGURE 8

CONCENTRATION OF TOXAPHENE IN WHITE SHRIMP PENAEUS FROM TERRY CREEK PPM
H = HEAD AND THORAX A = ABDOMEN

(DOUBLE BARS INDICATE REPLICATE SAMPLES, 70-71 = MEAN OF 8 SAMPLES COLLECTED 1970-1971, 71-72 = MEAN OF 13 SAMPLES COLLECTED 1971-1972.)

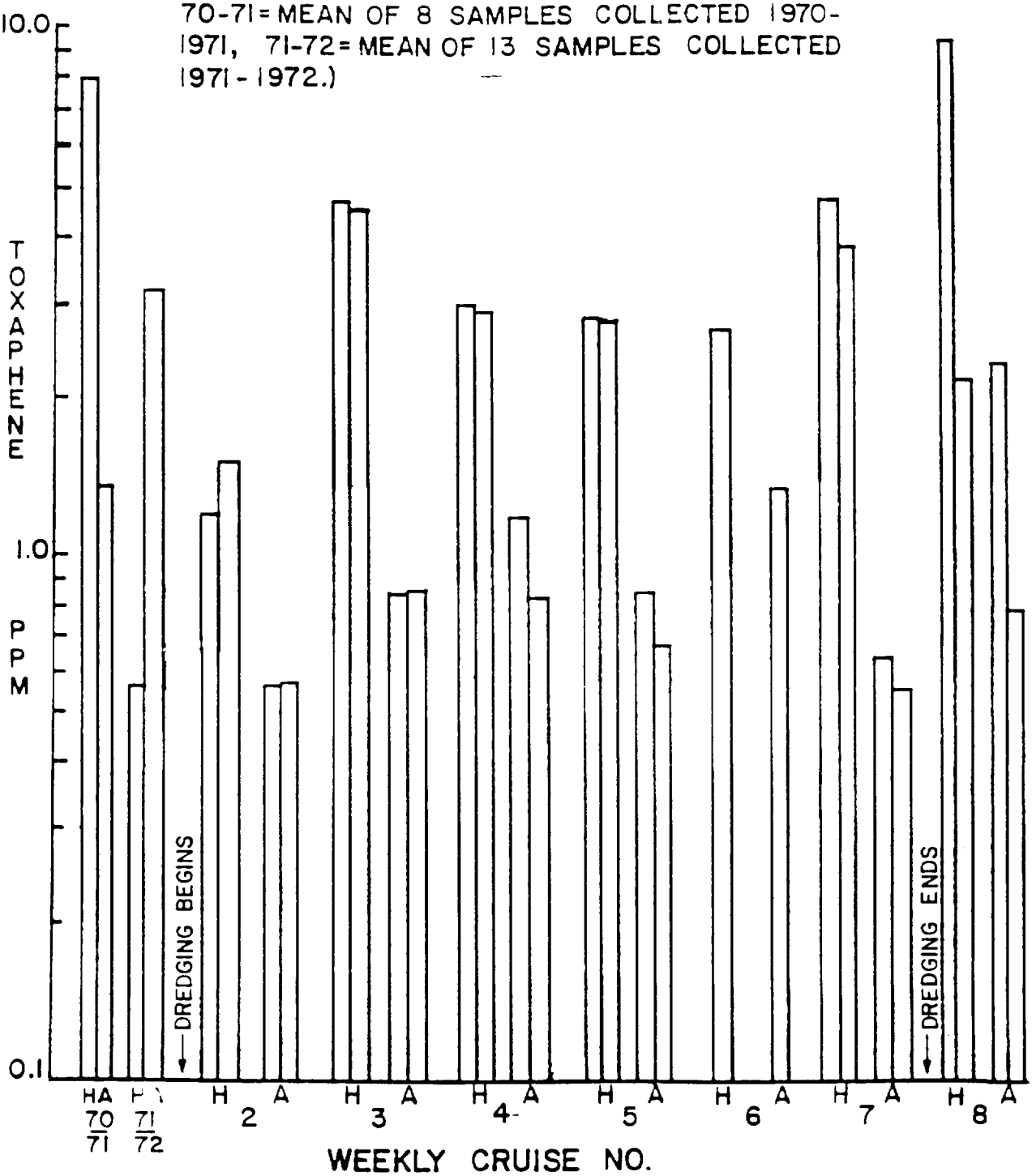


FIGURE 9

TOXAPHENE CONCENTRATIONS IN ANCHOVY ANCHOA MITCHELLI FROM TERRY CREEK PPM

(DOUBLE BARS INDICATE REPLICATE SAMPLES, 70-71 = MEAN OF 8 SAMPLES COLLECTED 1970-1971, 71-72 = MEAN OF 11 SAMPLES COLLECTED 1971 - 1972.)

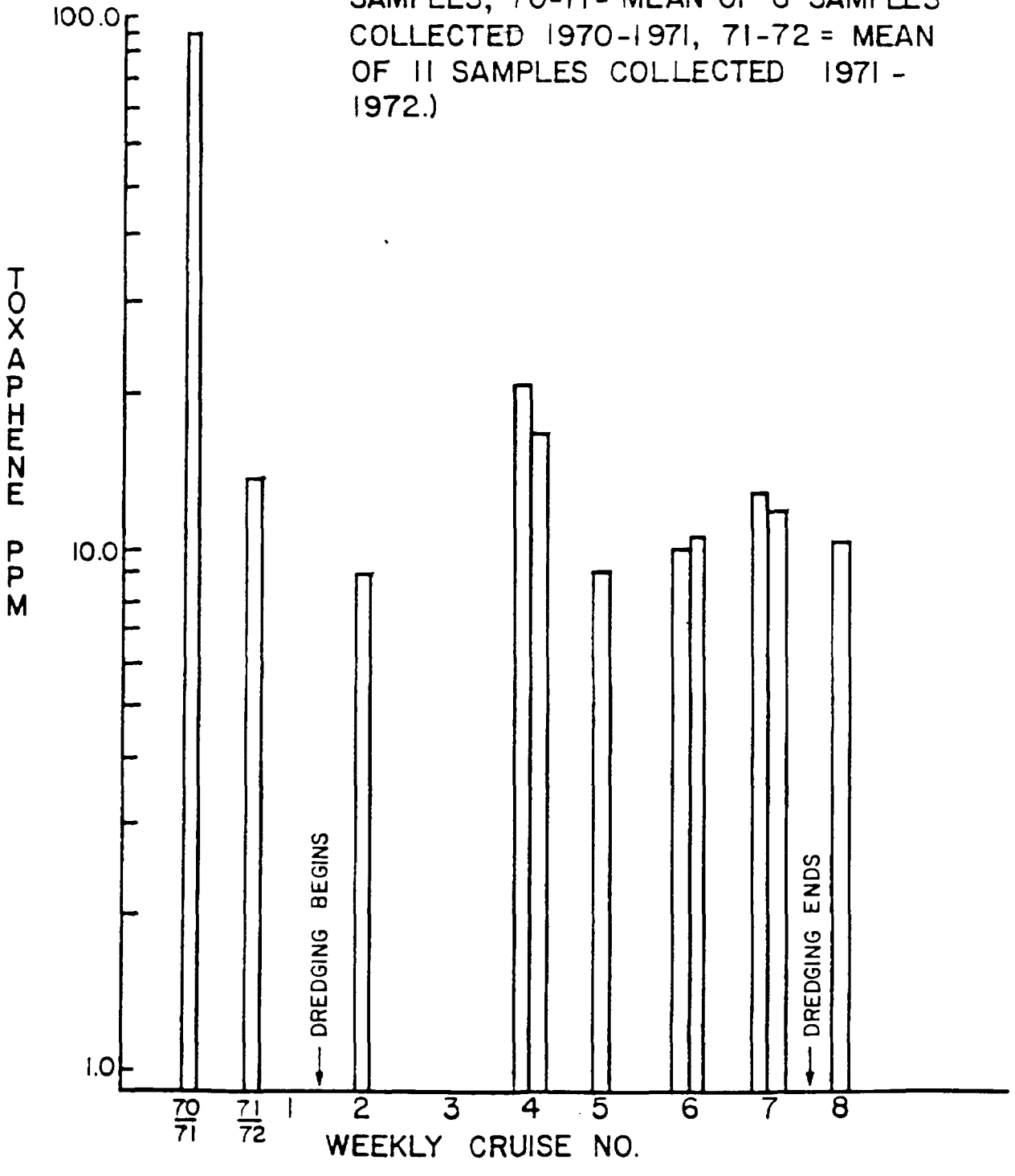
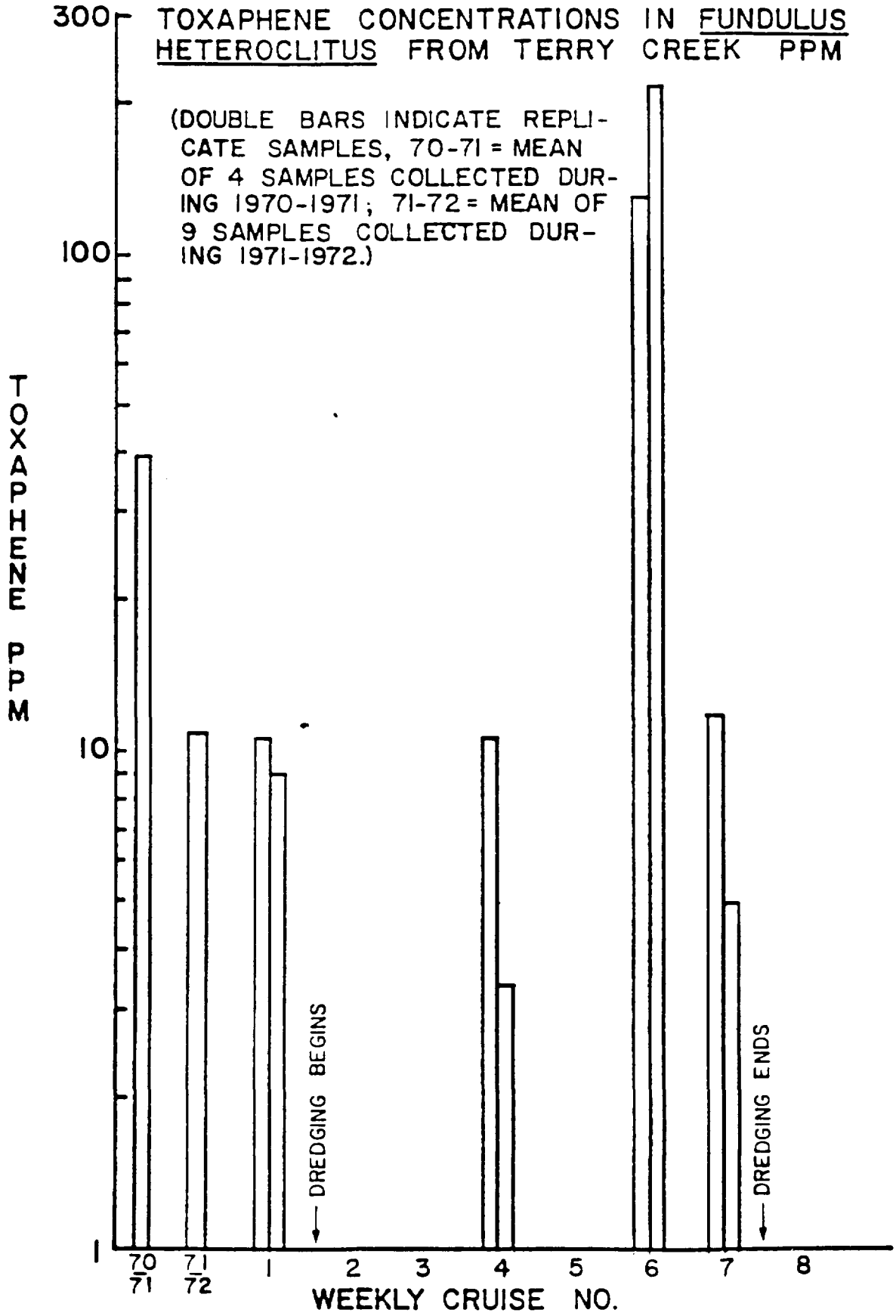
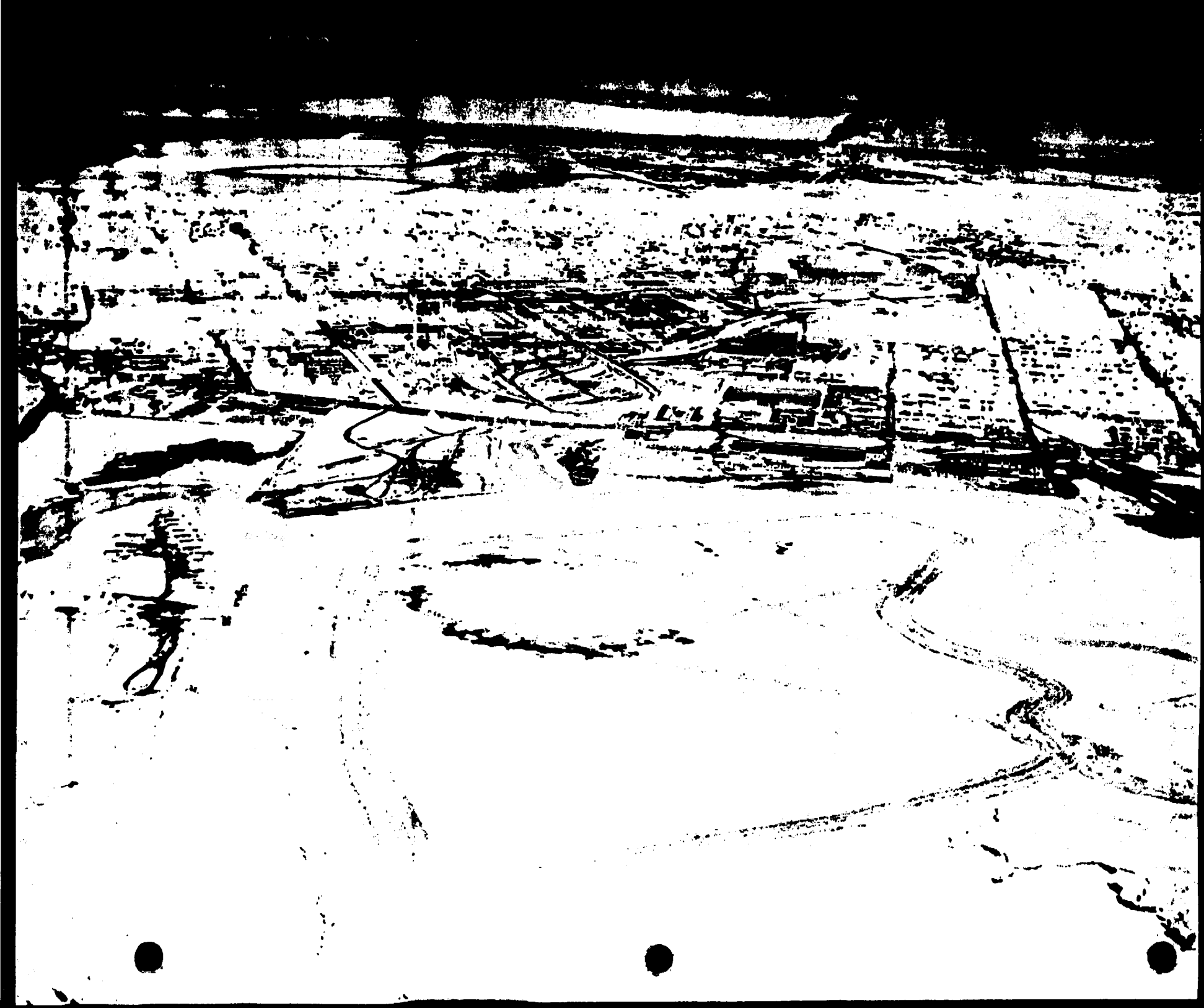


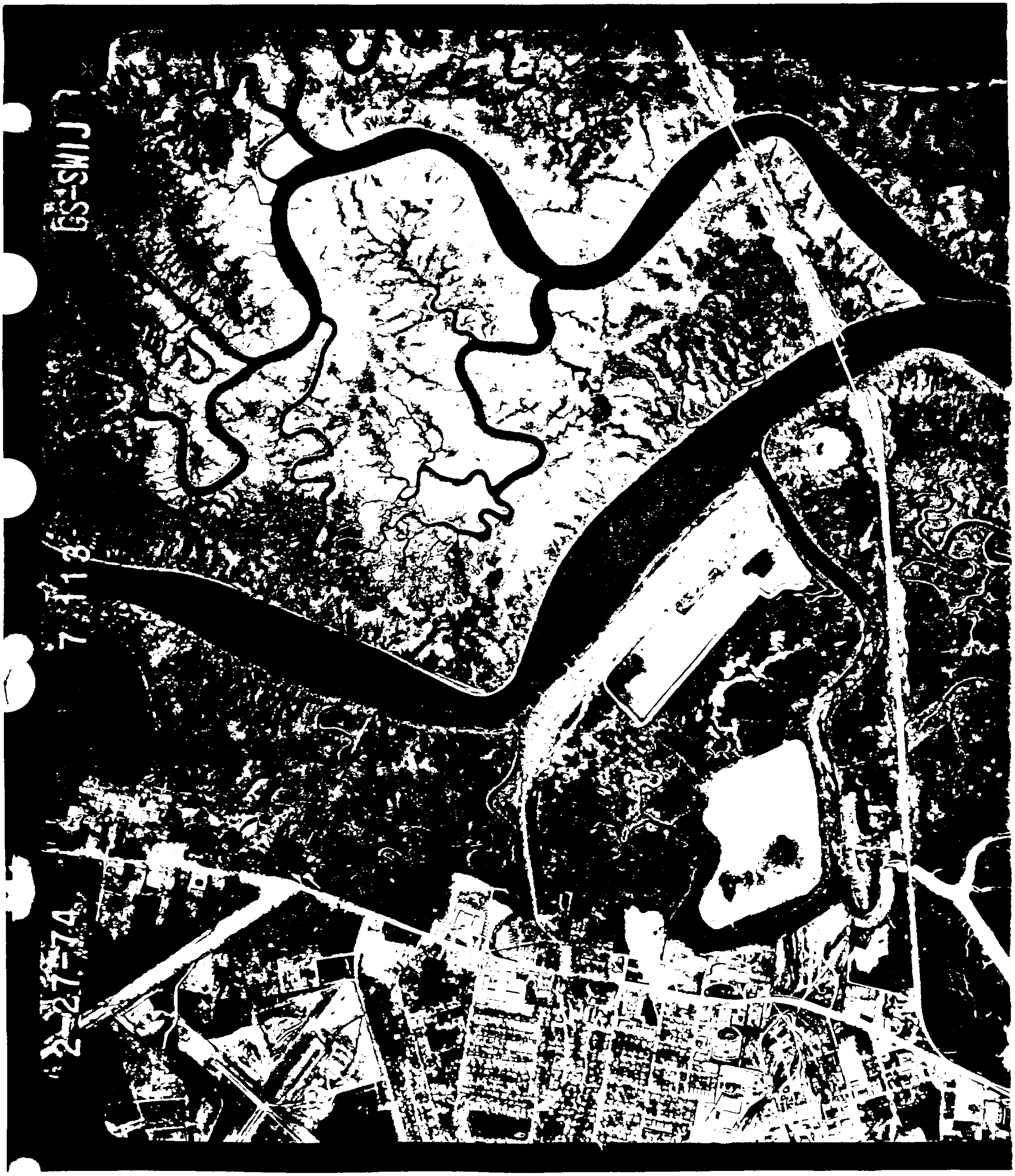
FIGURE 10


TOXAPHENE CONCENTRATIONS IN FUNDULUS HETEROCLITUS FROM TERRY CREEK PPM
(DOUBLE BARS INDICATE REPLICATE SAMPLES, 70-71 = MEAN OF 4 SAMPLES COLLECTED DURING 1970-1971; 71-72 = MEAN OF 9 SAMPLES COLLECTED DURING 1971-1972.)
300
100
10
1
TOXAPHENE PPM
DREDGING BEGINS
DREDGING ENDS
70/71
71/72
1
2
3
4
5
6
7
8
WEEKLY CRUISE NO.

Attachment #5




152.269MM 20,000'ASL AF68-24 R-9-1
1806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